Coyle, F. A. 1983. Aerial dispersal by mygalomorph spiderlings (Araneae, Mygalomorphae). J. Arachnol., 11:283-286.

AERIAL DISPERSAL BY MYGALOMORPH SPIDERLINGS (ARANEAE, MYGALOMORPHAE)

Frederick A. Coyle

Department of Biology
Western Carolina University
Cullowhee, North Carolina 28723

ABSTRACT

Ballooning, a form of dispersal rarely seen in mygalomorph spiders, was observed one early spring day in about 30 *Sphodros* spiderlings. After ascending a stump, each spiderling became airborne by dropping and hanging from a dragline which then gradually lifted and lengthened in the breeze, broke at its attachment point, and served as the ballooning thread. Although less effective than the aerial dispersal mechanisms of many araneomorph spiders, this technique can nevertheless produce higher and longer flights than Bristowe and others have suspected.

INTRODUCTION

Although ballooning is a common dispersal mechanism for many kinds of araneomorph spiders, it is presumably only rarely employed by non-araneomorph spiders. I am aware of only five published accounts of ballooning or pre-ballooning behavior in non-araneomorph spiders. Enock (1885) and Bristowe (1939) each observed spiderlings of *Atypus affinis* Eichwald (Atypidae) leaving their maternal tubes on warm, early spring days, trailing draglines, and ascending plants, an apparent prelude to ballooning. Enock (1885) described how some of the spiderlings ascended single-file to the top of a 3 m tall garden stake and "were blown off into mid-air, still keeping a hold upon their endless silken cords, until they became attached to other sticks" which they ascended, only to be blown off onto the ground. Muma and Muma (1945) witnessed similar pre-ballooning behavior by spiderlings of another atypid, *Sphodros rufipes* (Latreille), under laboratory conditions. Although the Mumas reported that the spiderlings climbed upward from the maternal web in single-file, forming a heavy band of silk with their draglines, and then ballooned, they did not describe the ballooning process. Baerg (1928) described how groups of *Ummidia carabivora* (Atkinson) spiderlings (Ctenizidae) disperse during March by walking single-file from the maternal burrow over the ground and up into a tree, leaving behind a conspicuous silk trail. He reported that, once in the tree, each spiderling proceeded "to spin out a thread of silk," but he did not actually observe ballooning. Main's (1957) observations that captured spiderlings of *Conothele malayana* (Doleschall) "produced copious amounts of goassamer," led her to postulate dispersal by ballooning for this widespread ctenizid species which is closely related to *Ummidia.* Although strongly suggesting that these four mygalomorph species do balloon, these observations are incomplete and have understandably been treated with great caution (Bristowe 1939,

Gertsch and Platnick 1980). Consequently, the following account of my fortunate encounter on March 22, 1982, with ballooning *Sphodros* spiderlings (probably *Sphodros atlanticus* Gertsch and Platnick) is important.

RESULTS

The 30 spiderlings that I observed were the last of a larger number of spiderlings that had emerged earlier that day from their maternal tube attached to the west side of a 1 m tall hawthorn stump in a 30 m wide strip of pasture between a hardwood forest and my house, 5 miles south of Cullowhee, North Carolina. I observed the spiderlings from 4:30 pm until the last spiderling departed 47 minutes later. The weather was clear and warm (70°F) with a breeze coming from the west. All these spiderlings were maneuvering on or very near a silk platform composed of draglines which they and their siblings had deposited during their pre-ballooning activity. This silk sheet (Figs. 1 and 2), which was 30 cm long and 11 to 15 cm wide, covered and spanned the spaces between the ends of the three branches (two main and one secondary) which formed the top of the stump. The sheet was thickest around the edges. A band of silk 1 to 1.5 mm wide extended from the upper end of the maternal tube up along the trunk surface to the platform and probably marks the ascent route followed by most or all of the brood.

Ballooning was accomplished in the following manner: Each spiderling would walk along the sheet ascending each slope it encountered,finally arriving, in most cases, on the tip of the smallest branch (Figs. 1-4), which was the most upwind and nearly the highest point on the stump. If not yet on the edge of the sheet, the spiderling would walk to the edge. It would then tilt its cephalothorax upward, lift its first two or three pairs of legs off the silk, and extend them out from the edge. Then the spiderling would drop 5 to 15 cm down from the edge on its dragline. Frequently, during or after such a drop, the breeze would force the spiderling against the trunk, in which case it would ascend the trunk to the platform and repeat the orientation and dropping process. These unsuccessful launches produced the abundance of roughly vertical threads running from the platform edge to the trunk surface (Fig. 3). Elongate holes in the sheet near its highest point (Fig. 4) were probably cut by some spiderlings and used as short-cuts to the upper surface of the platform after unsuccessful ballooning attempts. Sometimes a spiderling would return to its launch site at the platform edge simply by climbing up its dragline, a slower and clumsier process than the dragline climbing I have observed in some araneids. Occasionally, after dropping, a spiderling would not drift into the side of the trunk, but would be blown past and away from the trunk surface. Such a spiderling would then, from time to time, lengthen its dragline, and the force of the breeze would incline the line more toward the horizontal each time. Eventually the dragline would become long enough that the force of the breeze would break it near its point of attachment to the platform and the dragline and and attached spiderling would drift through the air.

Trajectories varied among the eleven spiderlings which I watched as they became airborne. Three drifted downward at the start of their flight and probably landed in the grass 5 to 10 m downwind from the stump. Four rose slowly as they ballooned, but I lost sight of them 5 to 10 m downwind from the stump. One rose steeply at a 30° to 40° angle but I lost sight of it about 4 m downwind from the stump at an altitude of about 3 m. I tracked one ballooning spiderling 20 m before it was lost from view at a height of 4 m. Two ballooning spiderlings drifted into the top of a 1.2 m tall dead weed 0.5 m

downwind from the stump. These then used this plant, which was covered with draglines from earlier balloonists, as a launch site for additional flights.

DISCUSSION

This method of ballooning is clearly different from the common araneomorph method described by Bristowe (1939) and many other authors: "The spider stands on tip-toes, pivoting its body round to face the wind, [tilts its abdomen upwards,] squeezes out a little silk, which is rapidly hauled out by the wind without any assistance from its hind legs, and then, when the pull on the threads from the upward air-current is sufficient, away floats the spider" (Bristowe 1939). A second, less common, but similar mode of araneomorph ballooning is described by McCook (1890). Bristowe (1939) claims that the ballooning threads of araneomorphs are produced by a different pair of spinnerets than is the dragline, and he, like Jonathan Edwards more than 200 years earlier (Smyth 1890), described how an araneomorph may spin these ballooning threads while hanging from its dragline. The spider and its ballooning threads are eventually bouyed up into the air with enough force that the dragline breaks and the spider becomes airborne. I am reasonably confident that the *Sphodros* spiderlings I observed were not taking flight in this manner, for although I could usually see the dragline before and sometimes after launching, I did not see other threads extending from the spiderling.

The *Sphodros* method of ballooning, which involves dropping and hanging from a dragline that is lifted and lengthened by the breeze, breaks near the substrate, and serves

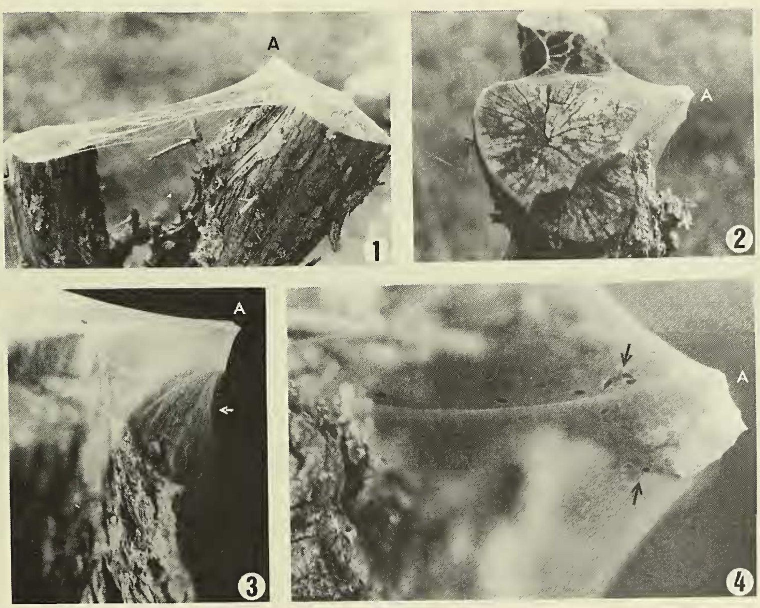

Fig. 1-4.—Ballooning platform constructed by *Sphodros atlanticus* spiderlings: 1, looking slightly down on platform into the wind; 2, looking slightly down on platform, wind coming from the right; 3, dragline threads (arrow) extending downward from primary launch site to side of trunk. These threads were left by spiderlings that were blown into the trunk after dropping from the platform edge. 4, close-up view of upper surface of platform near small branch tip showing holes (arrows) cut by some spiderlings returning to the upper surface. A, tip of small branch from which most of the spiderlings attempted to launch themselves during the course of my observations.

as the ballooning thread, has also been observed in dysderid and segestriid spiderlings by Bristowe (1939, 1958). This is probably a more primitive and shorter distance form of ballooning than that practiced by higher araenomorphs; although it is clear, at least for *S. atlanticus*, that this method can produce longer and higher flights than Bristowe (1939, 1958) had suspected. If, as I have observed, these spiderlings repeat the ballooning process after drifting into tall vegetation, moderately long distance disperal is possible even in the forest habitats that many *Sphodros* species frequent. This aerial dispersal mechanism produces the interesting intrademe distribution patterns of *S. rufipes* (Coyle and Shear 1981) and *S. atlanticus*, whose tubes are widely scattered, with seldom more than one tube per tree. Similar burrow distribution patterns that I and others (W. J. Gertsch, pers. comm.) have observed in *Ummidia* species are not surprising in light of the evidence that *Ummidia* spiderlings balloon. In contrast, the highly clumped burrow distribution patterns common for antrodiaetid (Coyle 1971) and many other mygalomorph spider taxa, suggest that these spiders do not balloon.

ACKNOWLEDGMENTS

Special thanks are due to my wife, Diane, who first noticed the *Sphodros* spiderlings on their silk platform and alerted me.

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Manuscript received April 1982, revised May 1982.

NOTE ADDED IN PROOF. On 12 March 1983 I observed another ballooning platform on the same stump. Its good condition and the fact that it was almost totally destroyed within three more days suggest that it was formed a day or two earlier during a period of warm sunny weather. The fact that its position and form were virtually identical to the previous year's platform indicates that this new brood of spiderlings performed the same ballooning behavior patterns I have described for the previous year's brood.